

CITY OF KENT



2011 WATER SYSTEM PLAN

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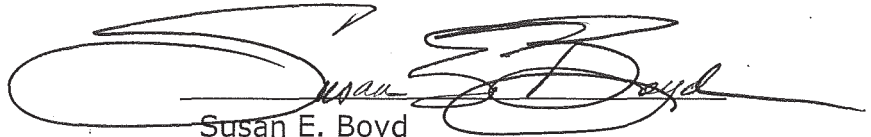


**CITY OF KENT
2011 WATER SYSTEM PLAN
PROJECT CERTIFICATION**

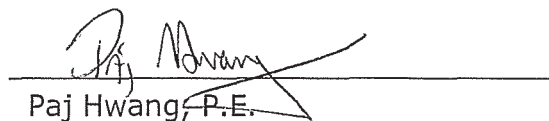
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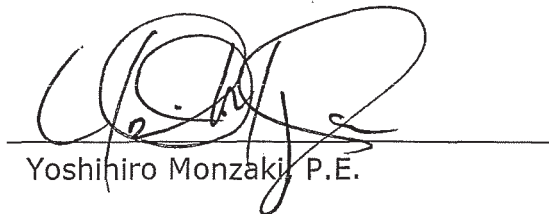
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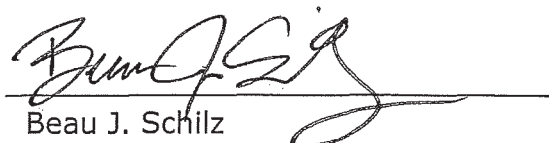
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2011 WATER SYSTEM PLAN EXECUTIVE SUMMARY

The City of Kent's 2011 Water System Plan presents a compilation of planning and engineering studies completed by a team of City representatives and private consultants. The Plan updates and supersedes the City's 2002 Water System Plan and subsequent amendments thereto. The primary purpose of the planning process was to determine the adequacy of the existing water system to meet current and projected needs of residents and businesses. The Plan has been developed to complement and coordinate with other key City of Kent planning documents, most importantly, the City's 2004 Comprehensive Plan. In accordance with Growth Management Act (GMA) planning requirements, six-year and long range planning horizons were the basis for developing a capital improvements plan for the water system. The Plan has been prepared in accordance with the rules and regulations of the State of Washington Departments of Health and Ecology, the requirements of the City of Kent, and the requirements of King County.



RETAIL WATER SERVICE AREA

The majority of the water system retail service area (or "service area") is located within the incorporated City of Kent, plus some small additional unincorporated areas within the jurisdictions of King County and the City of Auburn. The boundaries were established under the adopted Coordinated Water System Plan for South King County and include approximately 24 square miles, 20 of which are within the incorporated city limits. The service area is generally bounded on the west by Interstate Highway 5, on the east by 124th Avenue SE, on the north by S. 180th Street, and on the south by S. 277th Street. The City's service area is bordered on all sides by adjacent public water systems and no service area changes are contemplated herein.

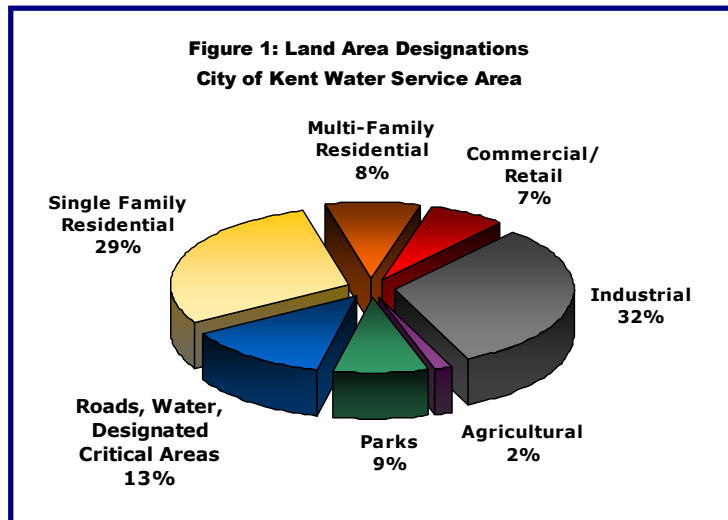
WATER SERVICE POLICIES

Water system planning and operation falls under a myriad of planning and engineering requirements that dictate the need for established service area policies. Customer service policies associated with the Kent Water System are in accordance with City standards, GMA requirements and a variety of rules and regulations put forth by the State Department of Health. A significant change since the City's 2002 Water System Plan is the implementation of the State of Washington's Municipal Water Law. As described in Chapter 2 of this Plan, the Municipal Water Law (MWL) impacts a variety of water system operations. Important considerations incorporated into this planning process and documented in the City's established goals and policies fulfill the "Duty to Serve" requirement of the MWL. In

establishing the water service area put forth in this document, the City of Kent is committed to providing domestic water service to all properties within the service area. Chapter 2 provides the framework for providing that service in a timely and reasonable manner. That Chapter also summarizes the City's commitment to providing high quality domestic water and fire protection service in accordance with all governing regulations and requirements. Of particular importance in the development of this document has been formalizing routine procedures for the protection of the environment and water supply resources through wellhead protection, water system security and conservation programs.

LAND USE, POPULATION AND EMPLOYMENT

General government services and land use planning within the service area are provided by the City of Kent and, for a small area in the eastern portion of the service area, King County. This Plan has been developed to coordinate and interface with other City of Kent



planning documents, especially the City of Kent 2004 Comprehensive Plan (and amendments thereto). The water service area includes a vital downtown urban center, industrial and commercial use in the valley and multi-family and single family residential developments along the valley slopes and plateaus. Kent is considered a major employment center of the Pacific Northwest and is home to a number of major corporations and industrial facilities.

Population and Employment projections were developed using information from the Kent Planning Department and Puget Sound Regional Council and represent realistic scenarios for the six-year and long-range planning horizons. Water system planning is primarily based on ultimate development scenarios and fire flow needs. The premise of the Water System Plan is that the water service area will be essentially built-out by 2030 although it is recognized that the exact timing of that growth remains unknown. It is important to note that the boundaries of the water service area do not correspond with the Kent city limits, limiting the ability to correlate the water service area projections with those put forth in other City planning materials.

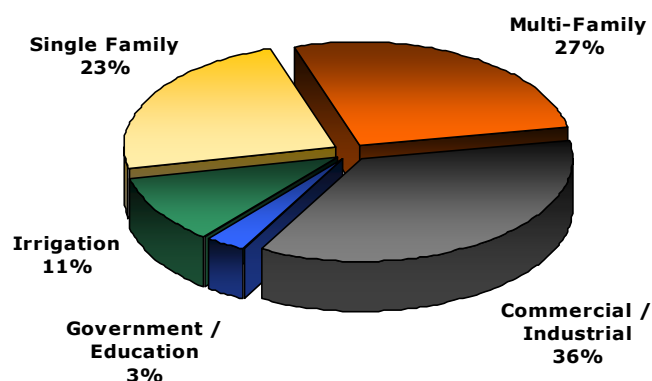
It is anticipated that the population of the water service area will increase from approximately 65,500 in 2008 to an estimated 70,500 people in 2030. Employment is expected to increase from approximately 55,000 in 2008 to nearly 69,500 in 2030. The forecasting methodology used to develop these projections is put forth in Chapters 3 and Appendix D of this Plan.

WATER DEMANDS

Identification of historic and projected water system demands is a critical element of the planning process and was accomplished using detailed water production and billing data through December 2010. System wide, annual water consumption is nearly 2.7 billion gallons, with average day demands of approximately 7.5 million gallons/day and peak day usage estimated at approximately 13.75 million gallons/day. Using the same estimated use per Equivalent Residential Unit (ERU) to provide an estimate of future water supply requirements, water demand by 2030 would approach 3.6 billion gallons annually or approximately 9.9 million gallons per day. Average use per single family residence or ERU is estimated at just under 200 gallons/day including an allowance for non-revenue and unaccounted for water lost through leaks, unauthorized uses, and water system operation and maintenance. Average unaccounted-for water in the City system has remained less than 4% over the past six years, far below regional averages and well within engineering standards. Non-revenue water within the City has declined steadily since the early 1990s, when the rate ranged from 10 to 12% annually.

Water use by customer type is indicated in Figure 2 and as shown, the residential population of the service area consumes approximately 50% and non-residential water use accounts for the remaining 50% of the total demand on an average annual basis. During the summer months, however, residential use increases significantly due to lawn watering and increased domestic use. Comparing water use by customer type to the land area designations shown in Figure 2, indicates that water demand typically corresponds to the total land area makeup of the customer type. Multi-family customers are the exception simply because more residents occupy less space. Of the total 13,700 (2010) active service connections, approximately 11,500 are residential (84%) and 2,200 (16%) are non-residential.

**Figure 2: Water Use by Customer Type
Based on Average Daily Demand**



WATER CONSERVATION

The City has identified a program for reducing water demands within the service area and works closely with neighboring purveyors to educate the public about stewardship of water resources and water conservation. Two types of demand management strategies are employed in the overall water use efficiency program: supply side strategies associated with alternative sources and/or improved system efficiencies; and demand side strategies that focus on reducing the amount of water used by customers. As outlined in Chapter 5 of this Plan, the City of Kent utilizes internal conservation measures, customer awareness

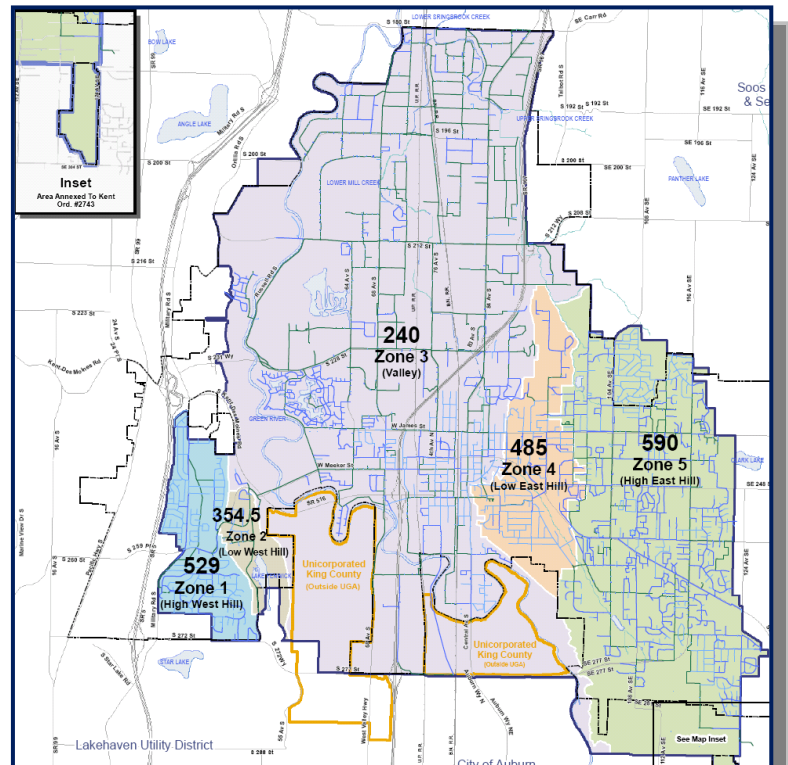
programs and participation in regional conservation efforts to maintain healthy environmental flows and capacity in its water resources. Consideration of the results from the conservation and water use efficiency programs identified in this document could reduce average day demand by approximately 0.4 million gallons per day or 146 million gallons annually, and those items will be selected to meet the needs of the water system in the most cost effective manner.

WATER RESOURCE PROTECTION

The Kent water system is supplied by multiple groundwater sources located throughout the water service area. These sources of supply are served by aquifers that underlie the Green and Cedar River drainage basins and the water service area. The documentation of existing and pending water rights provided in Chapter 4 and the analysis put forth in Chapter 7 clearly indicates that the City's groundwater sources, combined with seasonal water purchases from the Tacoma Second Supply Project (SSP), are adequate to meet the projected water demands for the six-year and long-term planning horizons. Protection of the aquifers supplying water to the City's water sources and the water source facilities themselves is of paramount concern to the City. Existing and planned efforts to maintain and protect the viability of water resources include a Wellhead Protection Program that is presented in detail in Appendices L and M (Water System Plan Volume 2). Other efforts include the City's Habitat Conservation Plan, Water Conservation Plan and various strategies for supply management that are detailed in Chapters 4 and 5.

EXISTING WATER SYSTEM

The water distribution system consists of over 270 miles of water mains, 8 storage reservoirs with a total capacity of approximately 21 MG, and six primary pumping stations. The water system is presently divided into five primary pressure zones based on property elevation and Hydraulic Grade Line (HGL). The primary water supply sources for the City are Clark Springs, Kent Springs, East Hill Well(s) and the Tacoma Second Supply Pipeline connections. Seasonal or supplemental water supply sources are typically provided through other City owned groundwater wells and the City also maintains emergency interties with neighboring purveyors.



SYSTEM ANALYSIS

The water system planning effort included verification of existing minimum design criteria in accordance with the most current DOH standards. Fire flow requirements for each pressure zone were established and verified with Fire Marshal requirements. Using these criteria, analysis of the existing water system was performed to determine the current and anticipated water system needs. The primary focus of the analysis is an evaluation of existing facilities to meet the projected needs of the anticipated population of the service area. This was accomplished using standard engineering calculations in accordance with State Department of Health standards and WaterGEMS™, a GIS-based hydraulic modeling software developed for distribution system evaluation.

Source of Supply Analysis

The Kent water system is supplied by a combination of City-owned groundwater sources and the Second Supply Project with the City of Tacoma and neighboring purveyors. The City currently maintains 20 individual wells at 9 separate locations throughout the water system. In addition, the SSP provides the Kent system with an additional water supply during the summer months. The total yearly average supply of the City's existing sources (excluding interties) is 17.45 MGD, while the peak dependable supply is estimated at approximately 30 MGD. Evaluation of the source of supply reveals adequate water supply to meet long range projections for water supply needs, although there is a slight deficit in supply in the near term. Installation of back-up power equipment at several source facilities will increase system reliability and in doing so, eliminate any source deficits. Source improvements included in the CIP are related to rehabilitation of source wells, protection of existing resources through property acquisition and increased wellhead protection measures and ultimately, participation in filtration facilities associated with Tacoma supply through the SSP.

Water Quality

The City of Kent's water supply is classified as groundwater, except for the water received from the SSP. The current quality of the water supply is excellent and requires only minor treatment for chlorination, fluoridation, and pH adjustment to reduce corrosivity in the distribution system. Water system quality is regulated by the federal Environmental Protection Agency (EPA) and the state Department of Health (DOH). EPA has delegated primacy (primary enforcement responsibility for water quality) to the State of Washington under the provisions of the federal Safe Drinking Water Act (SDWA). In order to maintain primacy, the state has adopted drinking water regulations at least as strict as federal regulations. As detailed in Section 8, a comprehensive water quality monitoring program is in place. A copy of the most recent Consumer Confidence Report is contained in Appendix H.

Water Storage

There are eight above ground storage reservoirs located throughout the water service area, providing a total gross storage capacity of approximately 21 million gallons (MG). Additional storage is required in the 529 pressure zone serving the West Hill and is recommended in this Plan. In addition, the Plan recommends isolation of an area of the existing 590 Zone to create a new 640 Zone with a new reservoir serving the higher elevations in the eastern portion of the service area. This new reservoir is anticipated to be constructed by the end of 2011.

Pumping

The City strives to provide gravity flow wherever possible but topography of the service area necessitates pumping to higher elevations. The system includes six primary pump stations, all of which are maintained in good working condition. Recommendations for pumping improvements include installation of back-up power at Pump Stations 4, 6, 7, and 8, upgrades to Pump Stations 3, 4, and 5 and construction of a new pump station to serve the proposed 640 Zone in the east portion of the service area.

Transmission and Distribution

Hydraulic modeling was used to evaluate the transmission and distribution system under existing, six-year and build-out scenarios and determine areas where system deficiencies exist, or are likely to develop, under various flow conditions. Deficiencies include areas of high or low pressure, areas with high flow velocities in the pipelines, and areas with low available fire flow.

In most areas, the water system is sufficient to handle average day demand (ADD) flows, and maximum day demand (MDD) flows with fire events through the year 2025. These conditions can, for the most part, be met while maintaining pressures above 20 psi for fire events, and also 35 psi during peak hour demand (PHD) flows. Pressures below 20 psi during fire events and 35 psi during PHD flows exist at higher elevations near tanks, which are to be expected, and in isolated areas of small mains in the distribution system. These areas become problems in fire flow events and construction of larger diameter mains in specific areas will alleviate fire flow limitations associated with new development or redevelopment within the service area.

Based on model results confirmed by operator information, a significant capital improvement planning program has been identified to take a proactive approach to regular system renewal replacements and provide for system upgrades required to accommodate anticipated development and redevelopment. It is anticipated that the City will address fire flow deficiencies through a combination of capital improvement, developer extension, and developer initiated redevelopment projects. Complete

details on the distribution system analysis and results are provided in Appendix E. Chapter 10 provides the Water System Capital Improvement Program and additional detail on recommended pipeline improvements is provided in Appendix G.

CIP AND FINANCING

The total Capital Improvement Plan identified in Chapter 10 indicates the need for \$75.5 million in water system improvements, although \$8.5 million of that is dedicated to street improvements that could be associated with the proposed water system improvements to reduce overall project costs. It is estimated that \$18.8 million in pipeline improvements are required to improve the transmission and distribution system to meet current and projected levels of development and required fire flow. Of that amount, approximately \$5.4 million in improvements have been identified as City renewal and replacement projects. The remaining \$15.5 million is expected to be required to serve new developing or re-developing properties and financed by developer extensions. Chapter 11 of the Plan identifies potential funding mechanisms for the recommended Capital Improvement Plan. The recommended CIP is significantly larger than that presented in the previous Water System Plan and past budgeting, partially due to the rapid escalation in construction costs in the past two years. Sufficient funds are not available to finance recommended improvements. A complete rate evaluation is being accomplished concurrent with the review and approval of this Plan by agencies having jurisdiction. A revised rate structure is anticipated and a key element of the rate review will be implementation of a strong conservation program through rate incentives. An update of connection charges is also recommended to ensure that new development pays its fair share of system-wide (or general facility) improvements.

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ACRONYMS AND GLOSSARY

ADD	Average Daily Demand
af	acre feet
ASR	Aquifer Storage and Recovery
AWWA	American Water Works Association
BPA	Bonneville Power Administration
CBD	Central Business District
ccf	One hundred cubic feet
CFR	Code of Federal Regulations
cfs	cubic feet per second
CIP	Capital Improvement Plan
City	City of Kent (unless otherwise indicated)
CPA	Conservation Potential Assessment
CSTM	Clark Springs Transmission Main
CWSSA	Critical Water Supply Service Area
CWSP	South King County Coordinated Water System Plan
DBP	Disinfection By-Product
DCVA	Double Check Valve Assembly
DM	Demand Management
DOE	Washington State Department of Ecology
DOH	Washington State Department of Health
DOT/APWA	Washington State Department of Transportation / American Public Works Association
DS	Dead Storage
Ecology	Department of Ecology
EPA	United States Environmental Protection Agency
ERU	Equivalent Residential Unit
ES	Equalizing Storage
ESA	Endangered Species Act
FAZ	Forecast Analysis Zone
fps	feet per second
FSS	Fire Suppression Storage
gal	gallons
GASB	General Accounting Standards Board
GFC	General Facility Charge
GIS	Geographic Information System
GMA	Growth Management Act
gpcd	Gallons per capita per day
gpd	Gallons per day
gpm	Gallons per minute
GRNRA	Green River Natural Resources Area
HCP	Habitat Conservation Plan
HET	High Efficiency Toilet
HGL	Hydraulic Grade Line

HH	Households
I-5	Interstate Highway 5
ICE	"In Concert with the Environment"
ITP	Incidental Take Permit
KCWD	King County Water District
KCWTD	King County Wastewater Treatment Division
Kent	City of Kent
KSTM	Kent Springs Transmission Main
If	lineal foot/feet
LFC	Local Facility Charge
MCL	Maximum Contaminant Level
MDD	Maximum Daily Demand
MG	Million Gallons
MGD	Million gallons per day
MOA	Memorandum of Agreement
MWL	Municipal Water Law
NMFS	National Marine Fisheries Service
OASIS	Optimization of Aquifer Storage for Increased Supply
OS	Operational Storage
PDD	Peak Day Demand
PHD	Peak Hour Demand
PSRC	Puget Sound Regional Council
PRV	Pressure Reducing Valve
Psi	Pounds per square inch
Qa	Annual Quantity
Qal	Alluvial aquifer
Qi	Instantaneous Quantity
RPBA	Reduced Pressure Backflow Assembly
RCW	Revised Code of Washington
SB	Standby Storage
SDWA	Safe Drinking Water Act
SKC	South King County
SPU	Seattle Public Utilities
SR	State Route (Highway)
SSL	Second Supply Line
SSP	Second Supply Pipeline
TAZ	Transportation Analysis Zone
TMP	Transportation Master Plan
TPU	Tacoma Public Utilities
UAW	Unaccounted-for Water
UGA	Urban Growth Area or Urban Growth Boundary
ULID	Utility Local Improvement District
USFWS	United States Fish and Wildlife Service
VFD	Variable Frequency Drive
WAC	Washington Administrative Code

WD	Water District
WDFW	Washington State Department of Fish and Wildlife
WFI	Water Facilities Inventory
WHPA	Wellhead Protection Area
WSA	Water Service Area or Retail Water Service Area
WUE	Water Use Efficiency
WWTP	Wastewater Treatment Plant

Glossary of Terms

Annual Demand – Total water system demand for one calendar year, expressed in millions of gallons (MG), including all uses and unaccounted-for water.

Average Daily Demand (ADD) – The annual demand divided by the number of days per year, expressed in million gallons per day (MGD).

Cross Connection – A physical arrangement connecting a public water system, directly or indirectly, with anything other than another potable water system, and capable of contaminating the public water system.

Dead Storage – The volume of stored water not available to all customers at the minimum design pressure in accordance with WAC 246-290-235 (5) and (6).

Equalizing Storage – The volume of water required to meet hourly variations in demand in excess of the available rate of supply.

Equivalent Residential Unit (ERU) – The amount of water consumed by a typical full time single-family residence. An ERU is used for converting users other than single-family residences into an equivalent number for the purpose of demand forecasting, system analysis and facility sizing.

Fire Flow – The rate of water flow, in gpm, required to fight fires under WAC 246-293-640 or adopted city or county standards.

Fire Suppression Storage – The volume of water required to accommodate fire demand.

Franchise Area – A designated area within which the utility system is permitted, by franchise, to own, operate and maintain facilities within public right-of-ways.

Legal Boundary – The corporate boundary established for the City water service area. Extension of service beyond the City's water service area legal boundary requires annexation to the City's water service area or specific agreement for the provision of such service. Also referred to as corporate area.

Maximum Contaminant Level (MCL) – The maximum permissible level of a contaminant in water the purveyor delivers to any public water system user.

Maximum Daily Demand (MDD) – The highest water demand anticipated for any given day, expressed in MGD.

Operational Storage – The volume of the reservoir devoted to supplying the water system while, under normal operating conditions, the source(s) are in “off” status.

Peak Hour Demand – The maximum rate of water use, excluding fire flow, which has occurred or is expected to occur within a defined service area at any instant in time.

Potable – Water suitable for drinking by the public.

Pressure Zone – A water supply or distribution subsystem operating at a uniform hydraulic gradient.

Retail Service Area – The recognized area within which the City of Kent intends to provide retail water service, as established by the South King County Coordinated Water System Plan. Also referred to in this Plan as *Retail Water Service Area* or *Service Area*. The Retail Service Area is shown on Figure 1-2 in Section 1 of this Plan. The area includes approximately 24 square miles, 20 of which are within the incorporated city limits. The service area is generally bounded on the west by Interstate Highway 5, on the east by 124th Avenue SE, on the north by S. 180th Street, and on the south by S. 277th Street.

Standby Storage – The volume of water required to augment the available supply of water during a period of partially or fully restricted flow from the supply source, due to such things as pipeline or pump failure or power outages.

Usable Storage – That portion of the total available storage that is available on a continuous basis, either by gravity flow or by reliable pumping facilities.